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# ANALYSIS OF EFFECT OF LEVOCARNITINE ON MUSCLE GLYCOGEN CONTENT IN TYPE 2 DIABETIC PATIENTS IN PAKISTAN

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**Abstract:**
***Introduction:*** *Glucose and lipid metabolism are inter related phenomenon in the human body. The number of people with T2DM is spiking worldwide, thus efficient management is required to improve the quality of life of diabetics.* ***Objectives of the study:*** *The main objective of the study is to analyze the Effect of Levocarnitine on Muscle Glycogen Content in Type 2 Diabetic patients in Pakistan.* ***Material and methods:*** *This case control study was conducted at Central Park Medical College during January 2017 to June 2017. Serum creatine phosphorkinase (CPK) levels were measured to exclude skeletal muscle disorder. There were 100 diabetic patients which were selected for this study. For this study we analyze the effect of levocarnitine on muscle glycogen content in type 2 diabetic patients. The data was collected through a detailed blood biochemical analysis. Fasting glucose levels were measured for further analysis.* ***Results:*** *Statistical analysis showed significant ($p < 0.001$) increase in weight (268.40 ± 14.65 gm), fasting serum plasma glucose level (404.05 ± 59.65 mg/dl), fasting serum TG (132.17 ± 6.25mg/dl), fasting serum HDL (62.28 ± 1.25mg/dl) and TG:HDL ratio (2.12) due to high fat diet. The serum free carnitine was measured by terminal sampling and glycogen content of the EDL muscle of both groups were calculated. An increase in glycogen content was observed in in diabetic group (82.55±10.30 mg/100 gm muscle).* ***Conclusion****: It is concluded that Levo carnitine increases the glucose uptake by the skeletal muscle and hence improves the skeletal muscle glycogen stores in type 2 diabetes mellitus.*

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## INTRODUCTION:

Glucose and lipid metabolism are inter related phenomenon in the human body. The number of people with T2DM is spiking worldwide, thus efficient management is required to improve the quality of life of diabetics. Initial management of T2DM consists of weight reduction, regular exercise and controlled diet. Exercise plays a dominant role in controlling hyperglycemia by way of increase in peripheral insulin sensitivity, strengthening insulin bonding and minimizing obesity [1].

Both glucose and free fatty acids (FFA) are consumed by skeletal muscles as sources of fuel for energy production. During the fasting state, FFAs provide major source of energy production, as skeletal muscle glucose uptake is considerably low [2]. After uptake of glucose, insulin secretion from the beta cells of pancreas is stimulated leading which lowers the rate of lipolysis leading to a reduction in plasma FFA levels. Simultaneously, there is a rise in the rate of glucose oxidation in muscle [3]. This transition from fatty acid oxidation to glucose oxidation is called metabolic flexibility. After transfer of glucose into the muscle cells through of GLUT-4 transporter (glucose transporter 4), it is phosphorylated by hexokinase, and then either oxidized by glycolytic pathway or stored as glycogen [4]. As the insulin levels rise, glycogen synthesis rate also improves, i.e; about 70% of glucose is converted to glycogen [5].

L-carnitine is the available form of carnitine present in the body and in food. Animal products such as meat, milk, poultry and fish are rich in L-carnitine. Levocarnitine is a synthetic form of carnitine, available in oral as well as injectable forms [6]. Levo carnitine has been used in various diseases like cardiomyopathies, metabolic nerve diseases, senile dementia, HIV infection, tuberculosis, myopathies, renal failure and anemia [7].

### Objectives of the study

The main objective of the study is to analyze the Effect of Levocarnitine on Muscle Glycogen Content in Type 2 Diabetic patients in Pakistan.

## MATERIAL AND METHODS:

This case control study was conducted at Central Park Medical College during January 2017 to June 2017. Serum creatine phosphorkinase (CPK) levels were measured to exclude skeletal muscle disorder. There were 100 diabetic patients which were selected for this study. For this study we analyze the effect of levocarnitine on muscle glycogen content in type 2 diabetic patients. The data was collected through a detailed blood biochemical analysis. Fasting glucose levels were measured for further analysis.

### Statistical analysis

Data was analysed using SPSS 17. Mean and standard deviation were calculated for all values. Statistical significance of difference between the subgroups was determined by applying independent samples t-test. ($p \leq 0.05$ was considered significant).

## RESULTS:

Statistical analysis showed significant ($p < 0.001$) increase in weight (268.40 ± 14.65 gm), fasting serum plasma glucose level ( 404.05 ± 59.65 mg/dl), fasting serum TG (132.17 ± 6.25mg/dl), fasting serum HDL (62.28 ± 1.25mg/dl) and TG:HDL ratio (2.12) due to high fat diet. The serum free carnitine was measured by terminal sampling and glycogen content of the EDL muscle of both groups were calculated. An increase in glycogen content was observed in in diabetic group (82.55±10.30 mg/100 gm muscle).

**Table 01:** Serum free carnitine levels and muscle glycogen content of groups

| Variables | Group I (Diabetic) n = 15 | Group II (Carnitine) n = 15 | Group I v/s II |
|---|---|---|---|
| **Carnitine levels (nmol/µl)** | 0.109 ± 0.014 | 0.312 ± 0.158 | $p < 0.001$ |
| **Glycogen content (mg per 100gm muscle)** | 82.55 ± 10.30 | 124.20 ± 17.78 | $p < 0.001$ |

All values are expressed as Mean ± SD

## DISCUSSION:

Our observation showed that *levo-carnitine* increased the muscle glycogen content in T2DM. The fast twitch muscles (type II) were used because they have comparatively more glycogen stores than the slow twitch muscle. Also, the lower levels of muscle glycogen in T2DM has been observed to be higher in type II muscle fibers as compared to type I muscle fibers [8]. Muscle glycogen is an important fuel for moderate to severe intensity exercise, and exercise is one of the initial regimens for management of T2DM. Studies have shown that *l*-carnitine increases insulin sensitivity in T2DM, thereby improving glucose uptake by all tissues up to 8% of the basal glucose uptake level. Carnitine has also been shown to improve PDH activity, resulting in reduction of plasma and skeletal muscle lactate levels by improving glucose oxidation. Studies have also proved that increase in plasma carnitine levels results in increased storage of skeletal muscle glycogen [9]. In present study, *l*- carnitine administration has shown to raise the plasma free carnitine levels 3 fold as compared to the diabetic group [10]. Studies by Tamamogullari *et al*. had determined the levels of total, free and esterified carnitines in humans and observed that the levels of these carnitines were decreased in diabetic patients. Free carnitine levels were found to be lower in diabetics while esterified carnitines were found higher in diabetics [11].

## CONCLUSION:

It is concluded that Levo carnitine increases the glucose uptake by the skeletal muscle and hence improves the skeletal muscle glycogen stores in type 2 diabetes mellitus.

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